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THE AMERICAN

GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXXII.—No. 1.
Whole No. 493.

NEW YORK, FRIDAY, JANUARY 2, 1880.

$3 PER ANNUM
IN ADVANCE.

A. M. CALLENDER & CO., Proprietors.
G. WARREN DRESSER, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European Countries, $3 50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers Street, New York, are agents for this Journal. Newsdealers will send orders to them.

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THE BROOKLYN CONSOLIDATION.

During the past two weeks the stockholders of the various gas light companies in Brooklyn have voted on the proposition for the proposed consolidation into one company, which had been submitted to them by a committee representing all the companies. The result has been that the stockholders of three of the companies failed to ratify the arrangement by a two-thirds vote, and the amalgamation, on the basis proposed, has not been effected.

The three companies failing to confirm the arrangement, voted as follows:

	No. Shares.	For consol.	Against.	Total vote.
Williamsburgh	20,000	13,313	1,653	14,966
Nassau	40,000	17,722	17,014	34,736
Peoples	100,000	15,408	66,611	82,019

All the other companies voted largely in favor of the scheme, although it is said that some loud protests were made by individual stockholders in some cases.

While we have always advocated amalgamation on a fair basis as for the best interests of both stockholders and consumers, it would seem that the opinion of the stockholders of three out of six of the old companies coincide with the views previously expressed in these columns, that the proposed arrangement in Brooklyn was not advantageous to all concerned. Too much capital in the business, in proportion to its volume, is not likely to be benefitted by still further increasing the capital.

The main object in arranging any amalgamation, or in remodeling the basis of any single company, should be to keep the capital at the lowest point possible for a comfortable and easy working of the business. This applies to the business management of the companies. When it comes to the question of manufacture, then the effort should be to apply every improvement for saving labor and fuel that is shown to be a success, and to carefully arrange the works so that the necessary labor should be employed at the best advantage.

The result of these arrangements will be to enable the manager to make good gas, sell it at a low price, secure an increasing business, and pay a good and sure dividend.

As will be seen, by the following from the New York *Tribune*, further attempts at amalgamation are to be made in Brooklyn. It is to be most sincerely hoped that the future efforts will be successful, and we doubt not they will be provided correct principles are applied to the problem.

"The consolidation scheme by means of which the six companies now furnishing gas to the citizens of Brooklyn expected to prevent ruinous rivalry having failed, owing to the refusal of the stockholders of two companies to agree, the prime movers in the proposed plan are trying to secure a new basis for union with which all will be satisfied. Those interested claim that a consolidation will surely be effected.

"Representative directors from the five Brooklyn gas light companies whose stockholders recently voted to ratify the agreement of consolidation met yesterday at the office of the Brooklyn Company to discuss the situation in which they were left by the refusal of the Peoples' and Nassau Companies to unite. * * President Benson stated in behalf of the Brooklyn Company that by the refusal of two companies to join in the consolidation, his company considered itself released from the agreement. The same announcement was made by the representatives of the Williamsburgh and the Citizens' Companies. The only company especially desirous of carrying out the consolidation on the basis proposed, reducing the capital in proportion to the amounts which had been allotted to the two companies which did not come in, was the Fulton Municipal, which the directors of all the other companies thought was receiving too large a share in getting $1,250,000 in the capital of the proposed new company. As the works of the Fulton Municipal Company can be completed at an entire cost of $450,000, the gain to it, it was said, from consolidation would be $1,000,000.

"A committee of one director from each company was appointed to consider the subject of a new basis for consolidation, and report at a future meeting."

[Communicated Article.]

Coal Gas: Is It a Failure?

Are coal gas companies another illustration that in time all governments, systems, institutions weaken and die? Certainly, if it is so, it is not much to their credit, as they have been in existence only fifty years. During that period they have built up a system of illumination which has dominated the world, and if new, at last, with all the advantages of success to encourage them, they are failing in usefulness, as it would appear they are, there must be a great and fatal cause somewhere. Where are we to look for it?

Are we to assume that coal is losing ground in its competition with other gas producing materials, or is the fault one of management? This question is a vital one. If its solution comes from the superiority of other materials there is nothing more to be said for coal; but if from the incapacity or want of active interest on the part of the directors of coal gas companies, or their officers, then there is much to be said.

The advantages of coal as a material for making gas for cities are so great it has been assumed until recently that no other material can supplant it. It is now claimed, however, that gas made from the decomposition of steam and enriched by carbon vapors obtained from oil or naphtha is better than coal gas, and more cheaply manufactured. And so clamorous are the advocates of that gas in forcing its claims upon the Public, it is perhaps a natural result that confidence in coal has been much shaken.

A very little reflection, however, will show beyond all dispute that the new gas (generally known as water-gas) whatever it may become in time—is not as yet established by reliable proof anywhere as an admitted success. On the contrary the fact is that of the many small gas companies which have been persuaded to try it, almost all have abandoned it; and, as far as we know, not even one still using it has given to the Public undisputed proof of superior economy.

It is true that in a few large cities sagacious capitalists have formed new companies to use the water gas in competition with the old established coal gas companies, and have taken away much of the business. But this proves nothing when it is considered that where the consumption of gas is very great, it can be sold at much lower prices than the companies interfered with were charging for it. The new companies, therefore, could undersell them, and still make a large profit, if thereby they secured their business, even although the cost of the water gas *in the holder* is greater than it would be if the gas was made from coal. We say "in the holder" only, as of course all other expenses are the same, or whether the gas distributed is made from coal, or steam and naphtha.

Granting, therefore, even that water gas companies have been a success, where, from the causes above stated, they have built up a large business, there is still no reliable proof that this gas can be manufactured at less cost than if made from coal. On the contrary, the inference is directly opposite for the following reasons:

The parties in control of these companies own the patents under which their works are operated. Now, where large quantities of gas are made, a very small gain in the cost of its manufacture aggregates a very great sum. It follows, necessarily, that if there was such a gain—say, only five cents per thousand feet—the value of the system for large cities would be so great, the evidence substantiating it, instead of being withheld as it is now, would be pressed upon the Public in every way possible.

We have now, we think, made a fair comparison between water and coal gas. Practically considered, is there any doubt that, until disinterested and detailed proof is furnished to the contrary, the former cannot be regarded as an advance in the art of gas manufacture. That conclusion being accepted, what excuse remains for the lethargy of the coal gas companies in the management of their business! Since the use of kerosene has become so general they appear to be paralyzed. From the first introduction of that oil it was evident that to meet the competition of so cheap an illuminator, better gas should be made, and every reasonable means taken to hold consumers. We all know that where such a policy was adopted it was an exception. Again, for years, the Public have needed a more convenient fuel than coal for summer use. What have the gas companies done to supply that want? Absolutely nothing. In the meantime vendors of kerosene have sold millions of oil stoves, no cheaper in operation than gas would be (assuming the gas companies gave the necessary inducements to its use as fuel) and objectionable both on account of smell, and trouble, and danger.

It is true there has been a prejudice against the use of gas for heating and cooking as expensive and unhealthy. But however just that feeling may have been formerly, it is not so now, and has not been so for several years, as again and again proved by reliable tests. It is also true that any gas company taking the trouble to furnish this proof to its consumers, and having foresight and energy enough to make heating and cooking with gas a department of its business—by furnishing, putting up, and caring for the necessary apparatus, *upon rent merely*—would have no trouble in introducing it successfully. As, if little gas is used, the rent charged would more than pay the interest on the investment, and for what is used the profit is very large—all the expenses for the extra manufacture, except coal and time, being already incurred.

Thus far, then, the record in support of our premises is bad enough. But it is not all. A new danger threatens. Oil has done its work. Judging from the past steam will have as fair a field. Everywhere we hear of the advantages of steam heating, and the formation of new companies to furnish steam to private houses for heating and cooking. What the end will be it is easy to see if the gas companies do not wake up and put into their business some of the energy and common sense which distinguishes their rivals.

Obituary.

Death of S. S. Ward, Pres. Hartford Gas Light Company.

At a meeting of the Board of Directors of the Hartford City Gas Light Company, held at the office of the Company, Dec. 19, 1879, the following resolutions were adopted:

Resolved—

That the members of this Board have learned with the most sincere regret of the death of S. S. Ward, late and for many years past, President and Treasurer of this corporation.

That the long official tenure of the deceased, going back as it does to the early history of the Company, his courteous bearing towards his associates, his strictly scrupulous, intelligent, and unfailing fidelity to the duties of his trust, are the well earned testimonies of his merit, and entitle his memory to the most honorable and grateful recognition by this Board, and by every member of the Corporation, as of a man who was as faithful and just in all his business and official relations as he was true, noble and blameless in all his social relations.

That the Secretary of the Board be instructed to transmit a copy of these resolutions to the family of the deceased; and, as a token of our respect, the members of this Board will as a body attend his funeral services.

J. P. Harbison, *Secy.*

Another Use for Gas Tar.

The following letter from Mr. James Howard, of Clapham Park, Bedfordshire, appeared in the *Times* not long since:—To the Editor of the *Times*—Sir: Two or three years ago you published a leter from me, in which I gave a receipt for an effective but non-poisonous dressing for seed corn. The appearance of this letter led to a wide adoption of the plan. Having been frequently applied to of late for information upon the subject, and having adopted some improvements—the result of experience—perhaps you will afford me space for the relation of my present practice. For 8 bushels of wheat, or 6 bushels of barley, take ½-pint of gas tar, 2 lbs. of blue vitriol, and 2 gallons of boiling water. The tar should be accurately measured (not guessed at), and should be of the consistency of treacle. After the tar is put into a pail, one gallon of the water should be poured upon it, and well stirred. The black, greasy scum which will rise to the surface should be skimmed off with a wisp of straw or piece of sacking to which it will readily adhere. While this operation is going on, another man should be mixing the vitriol with the other gallon of water. When ready, both lots should be mixed together and poured over the heap of corn, previously shot upon the barn floor. The heap should be turned over two or three times quickly so as to saturate the whole. If any tar or dregs remain at the bottom of the pail, they should not be poured on the grain, or it will stick together in lumps, and be likely to clog up the drill cups. I have used this dressing for several years with complete success. Not a single boy has been employed to mind the fields, nor has a gun been fired. The full plant, whether wheat or barley, has afforded evidence that no loss had accrued. A new bailiff, who wished to save trouble, planted a large field of barley last spring without dressing the seed; but some 200 sable depredators from a rookery hard by gave him a lesson which is not likely to be lost upon him for, as he remarked to me, the field was a constant source of vexation to him, while, as to the other fields subsequently drilled with dressed corn, he "could not find the mark of a rook-peck upon them." I may add that other birds appear to have as great an aversion to the taste of tar as rooks."—*Journal of Gas Lighting.*

Cement for Leather Belting.—One who has tried everything says that after an experience of 15 years he has found nothing to equal the following: Common glue and isinglass, equal parts, soaked for ten hours in just enough water to cover them. Bring gradually to a boiling heat and add pure tannin until the whole becomes ropy or appears like the white of eggs. Buff off the surfaces to be joined, apply this cement warm, and clamp firmly.—*Amateur's Handbook.*

Proceedings of the Seventh Annual Meeting of the American Gas Light Association.

HELD AT PHILADELPHIA, PA., OCTOBER 16, 1879.

[Continued from page 276.]

SECOND DAY—AFTERNOON SESSION.

Mr. Wood (Syracuse)—I have had a little experience in the use of gas stoves, but I do not believe that the gas stove business can be handled by individuals, but must be handled by gas companies. We arranged for the sale of gas stoves, and give them to our consumers at cost price in our town. We took particular pains, in the first place, to let the people in Syracuse know we had gas stoves by calling their attention to the fact. I invited a party of gentlemen to my office, and I brought a caterer there and gave them a good, square meal. The scheme operated very successfully. We gave them a meal in courses—giving them broiled shad, broiled oysters, broiled steak, roast quarter of lamb, etc. We made gravy, and heated water and washed the dishes four times. We set the table that number of times. As for the economy of them, I agree fully with the figures that Mr. Goodwin has given. I never tried any experiment to know what the cost would be in using coal and giving such a supper. The cost was $1.50 with gas at $2.50 per thousand. The fish and the meats were cooked extraordinarily well, and everybody was pleased with them. Among the party present that night I took particular pains that there should be the editor of our daily paper, as well as a Sunday morning paper. They gave us a very fine advertisement and local notice in each paper. Contemporaneously with that I prepared an advertisement on the subject and put it in all the papers at once. I also printed it on the back of our gas bills, and sent them to our consumers, so that the people of Syracuse knew that we had gas stoves to sell.

I do not think there has been anything brought into our community that has attracted so much attention. The people are ready for it. I could not go into the street, and meet friends on business or socially, or even go to church on Sunday, without being asked about that gas stove; and even the minister, after hearing him preach a sermon, asked me about it. There is no trouble in introducing the stove to your consumers, and no trouble in selling the stoves if you bring them properly before the attention of the people. I have placed these stoves in the best houses in Syracuse, where they have large ranges of the most approved patterns, and the occupants of such houses have told me that they considered them the best article of furniture that was in use in the house, and the most convenient. Many of these people are using them through the winter.

As to the cost of running these stoves, I have not heard the first complaint from any one. We have presented several bills, but no complaint has been brought to my attention in a single instance. I do not quite agree with Mr. Hawley about the profits that gas companies are going to make by putting up these stoves. I think it costs just as much for his plant, and for every item which goes to make up the cost of making gas for cooking purposes as for lighting purposes. I think we include all the elements of cost in the manufacture of gas in making it for cooking purposes the same as we do in making it for lighting purposes. I do not know that I have anything more to say upon this subject. There is no trouble in introducing these stoves in my judgment, if you only let people know that you have got them. If you can once introduce them, of course it will make a very great increase in your consumption of gas. The first stoves we got some time in May or June.

The Secretary—How much has your consumption increased?

Mr. Wood—We cannot tell. Since the oil excitement has come on, some of our consumers have left us and bought oil stoves, and have been burning oil. But they have been coming back; the oil don't suit them very well. The consumption of gas in these stoves for that reason has been somewhat intermittent, and I am not able to tell what our consumption has been during the whole season.

Mr. Neal—I am informed by the Committee on Arrangements that the use of this hall has been given free to the Association. I would therefore offer a resolution that the Secretary be directed to express our appreciation of the kindness and generosity of the officers of the Franklin Institute in giving us the use of this hall free of charge, and that a vote of thanks be tendered to the officers of the Institute for their courtesy.

Carried.

Mr. Neal—I would like to state, on behalf of the Executive Committee, that since the recess of the Association I have received some applications for membership. As I understand it, the business will be finished and the Association will adjourn at 7 o'clock to-day. It is therefore too late for the Executive Committhe to take the proper action upon these requsts for admission. I am sorry that they were not sent in before. I trust these applications will not fall to the ground, but that they will be presented at our next meeting. I merely state this in order that the gentlemen whose names have been proposed will understand it.

Major Dresser—On behalf of the Association, I wish to offer the following resolution:

Resolved, That this Association tender to the local committeee its thanks for the most admirable manner in which every arrangement for the comfort of the members and the success of this meeting has been made by them.

Carried.

Mr. Starr—I understand that the results of the interesting experiments made by Mr. Goodwin are to be published in a separate pamphlet. I think it would now be a good time for the members to come forward and give their orders for these pamphlets, which are to be given to the people of the community in which they live. I would ask Major Dresser to set me down for 500. I want to distribute them among our people, and if this information is put in tabular form it will save a great deal of trouble.

Major Dresser—It will save a great deal of expense in the printing of these pamphlets if the members will indicate the number they want.

Mr. Starr—If we go in proportion to the size of the town, I suppose Chicago will want 100,000.

Major Dresser—I am not able to state just what the cost will be, but it will be trifling; and, of course, the greater the number of copies ordered, the less the cost.

Mr. Starr—I suppose the statements of Mr. Goodwin will be published in the GAS LIGHT JOURNAL, and Major Dresser will then know about what the cost will be, and he can make a statement in the columns of the JOURNAL as to what it will be; and members can then send their orders to him by mail for the number of copies they desire.

Major Dresser—I think that will be the proper course to pursue.

Mr. McIlhenny—I desire to offer a resolution that the thanks of the Association be tendered to our worthy President for the very faithful and efficient manner in which he has performed the arduous duties of his office during this session. All in favor, please say "aye."

Carried.

Mr. Price—It is very well known that our friend Mr. Allen is here, and would like to make some remarks in regard to his particular system of making water gas, I suppose, or, at any rate, upon the subject of water gas. It is now somewhat late, and I suppose the members of the Association are a little weary; but I will put the question whether they will wait and listen to Mr. Allen or not.

Mr. Allen—I do not intend to occupy the attention of the Association more than 15 minutes.

The President—I think the gentlemen had better wait and listen to what Mr. Allen has to say.

Mr. Allen—Mr. President and gentlemen of the Association: The manufacture of gas is a science of no mean order, and it seems to me that the scientific principles upon which it is based should be discussed more fully than I have yet heard them.

I have heard a great deal said, and have seen a great deal written, with regard to how impurities in gas should be removed. For instance, I have heard a great deal said and have read many articles on the subject of how to avoid the formation of naphthaline, which has been called the curse of gas making for many years. I believe I have never heard the question asked, Can a good illuminating gas be made without the formation of a particle of naphthaline? I have heard the subject discussed in regard to the removal of ammonia. I believe, under the process that has been in operation for 75 years, there has never been a gas works that has made gas without making ammonia. The question has not been asked, to my knowledge, "Can gas be made without the production of ammonia? So with sulphuretted hydrogen and impurities that are formed under the process ordinarily used.

Now there are certain chemical results produced in the manufacture of gas which depend entirely upon the temperatures used. There are two forces that a gas manufacturer employs—expansion and contraction, heat and cold. Without heat there is no light. The impurities in gas are nearly all made at low temperatures. Good gas—perfectly formed chemical gas—is made at a high temperature. Coal tar and oil are distilled, commencing from 793° and running up to 1000°. In the ordinary process you make about 12 gallons of tar per ton of coal.

Now, when your heats are down, ammonia is formed by one equivalent of nitrogen and three of hydrogen uniting over red heats. If you pursue a process in which your heats are never lowered to red heats, you will have no ammonia.

Naphthaline is formed by a sudden change of temperature. It is a crystalization of the elements subjected to heat. If by a given process you produce certain proportions of the elements of gas, you will have no naphthaline. It is well known that in the production of illuminating gas there are about 100 simple gases that are combined together and form a compound in which there are 40 hydrocarbons. You have in the ordinary coal gas

which you use about 45 per cent. of volatile carbons. It requires only about from 7 to 10 per cent. of volatile carbon to make a good 16-candle gas. What becomes of the balance of the carbon? Under the ordinary process of making gas about 45 per cent. is marsh gas or light carburetted hydrogen. Have any of you asked the qestion why, with this large amount of carbon in the ordinary coal gas, you make 45 per cent. of light carburetted hydrogen, that has no more illuminating power than hydrogen or carbonic oxide? After you have made that, and have used up the carbon that is in the ordinary bituminous coal, you use from 5 to 25 per cent. of cannel coal to raise the illuminating power.

Many of you know a great deal more about gas making than I do, and yet there are some principles which I think I do understand in relation to it. Carbon is not a gas but a mineral; and it has the peculiar faculty or power of assuming the form of gas and uniting with other gases. It is a mineral, and the light is given by its becoming incandescent at the moment of exposure to the atmosphere. Carbon will not carry itself off from the retort, but it must have a supporting or permanent gas to take it up and carry it off; as I said, you make your supporting or permanent gas marsh gas or light carburetted hydrogen. What becomes of all the carbon until you have got that basis made? Look at your retorts. On the inside of them is pure carbon. Look at the twelve gallons of tar which you make per ton of coal, the greater part of which ought to be turned into gas. Look at the impurities that you make in your gas—sulphuretted hydrogen, ammonia, and naphthaline, the greater part of which ought to be turned into illuminating gas. Why don't you turn it into gas? Simply, because you do not, under the present process, have a supporting gas at the time when it is volatilized to take it up and carry it off. It, therefore, becomes deposited on the retort.

I want to say that I did not come here to speak with regard to our process particularly, but on the subject of water gas generally which, I think, is founded upon scientific principles. Water is the great antagonist of fire and yet it is composed of the most inflammable elements in nature. By the decomposition of water you form hydrogen and carbonic acid. Which two gases produce the highest calorific intensity of any of the gases. That is what you want. If you get your gas up to a certain degree of candle power it will smoke. What you want is proper combustion. Now, I say that a system of making gas which will produce a supporting gas at high combustion, and be present at the moment that the elements of gases are vaporized ready to take up the impurities and carry them off, is the true system of making illuminating gas. That is what we do with water gas. There are different systems of making water gas. We were the first in the field, and have been the longest in it. We have run our process at Poughkeepsie going on five years, and have been making pure, simple, water gas, and we are running the process to-day, and making a gas of a uniform candle power of from 20 to 21 candles. We have no trouble in making it, and we have no trouble in keeping it up to a uniform quality. We differ from the process that has been discussed here this afternoon in this; that we have always worked with a continuous process. We heat by external heat and they by internal heat, consequently, by their process, a draft of air is driven in until the heat is raised to incandescent or white heat, and then the steam is turned on. In a short time the heats are reduced so that they have to shut off the steam and turn the air on again. That is the way their process works. We run continuously, and therefore I say that in making gas uniformly the chemical combination that takes place must be according to the heat that is applied. If you vary the heat you vary the combination. The result is chemical and cannot be avoided. We, therefore, hold that the uniform production of gas will require a uniform degree of heat, and that is the system which we are pursuing.

I may say here, with regard to the cost of it, that I believe there can be nothing in that respect that we are not able to state in figures. We have run four and a-half years, and we are ready to show our books to those who come there. I would like to state just what it costs us, but I do not think that it would be proper. I will state it to any individual in this Association privately.

Mr. Neal—How do you carbonize your gas?

Mr. Allen—In regard to that a great deal has been said about the burning of the oil or the waste of the oil. I think we have the best system that can be devised. We have worked it until we think we have got it very nearly perfect. Our intention has been to show gas men that we are pursuing a scientific and chemical process. We vaporize our oil. The oil or naphtha, it is immaterial which, goes in with the hydrogen. If we use crude oil, it has some moisture in it, and it has to be dried, or undergo a process of drying, before sending it into the retort, while naphtha is entirely free from all moisture.

Mr. Neal—Do you use a small or secondary holder?

Mr. Allen—No, sir; it is all made by one process. We turn our oil on, it goes on to our vaporizer and returns. Nothing is touched from the time it starts until it passes out into the holder. There is no manipulation at all. We have, for instance, two benches for hydrogen. I wish to say a word with regard to hydrocarbons. Some of them are pretty volatile, and some are harder to break up. Any flash-in-the-pan, as you may say, carries it right off. That is the only proper way to do it. The most volatile carbons in the ordinary process are carried off before they get up to the point of gas making. That is the fruitful cause of the abuse of carbon. We send out hydrogen into the center bench. The oil bench is near it, and the naphtha and hydrogen pass down through the same vaporizer, and pass to the lower chamber or double retort, and from there through the diaphragm into the upper chamber, and then up into the center retort. We pass 1000 feet from three benches. You will see that no part of the gas can pass without passing some degree of heat; the more volatile passes off quicker, but there is the carbon to take it right up and it is formed immediately, and it goes through a degree of heat so that it becomes chemically formed. Now, when hydrogen or carbon is chemically formed it cannot be separated except by combustion, and good gas does not condense. It is pure vaporized gas that condenses. We pass the whole of it through one uniform system. It comes out through at one stand pipe, and you will see at once that there cannot be two qualities of gas. I do not believe in this system of making a rich quality of gas at one point, and turning it in and mixing it cold with a poor quality of gas. It will mix, but it is not chemically formed. After it has passed the hydraulic main, there is no chemical action takes place except the cold which is applied to it which will cause the poor gas to condense. It is very singular, but, notwithstanding, it is true, that carbon will so far unite with gas as to pass the water still and pass the purifiers into the holder, but it will deposit as it goes in the mains. I hold that we ought make a gas every foot of which, as it passes out of the retort, shall be pure.

The Secretary—How many gallons of oil or naphtha do you use per thousand feet of gas?

Mr. Allen—We take about four gallons of oil to one thousand feet, and we use about seventeen pounds of anthracite coal in the retorts per thousand feet of perfected gas.

The Secretary—How much outside?

Mr. Allen—The benches take up, for running the fires, just about the same as the ordinary coal gas. The fires have the same size bench, and require about the same coal as they do under the ordinary process of making gas.

A Member—What price do you sell your gas for?

Mr. Allen—$2; 5 per cent. off.

A Member—Does your company pay any dividends?

Mr. Allen—No, sir.

Major Dresser—Can you give us the total number of pounds of coal used under the boiler to generate your steam, and under the retorts for making your gas? You stated that you used about 17 pounds of anthracite coal in the retorts per 1000 feet; this, added to what you use under the boilers and in the furnaces, would give us the total pounds of coal per 1000 feet of gas.

Mr. Allen—I did not expect to discuss our particular process, and I did not bring the figures with me. If Mr. Harris, our engineer, had come, as I supposed he would, he would have brought the figures with him. If I had supposed that the discussion would turn upon our particular process I would have been ready with the figures myself. I only wanted to speak upon the principles of gas making, and of the differences between making water gas and the ordinary coal gas.

Mr. Page—What difference do you find in carbonizing your gas between using the oil that we sent you and naphtha?

Mr. Allen—We use the crystal oil for fuel and for carbonizing.

Mr. Page—Referring to naphthaline, are you aware of the fact that a patent has been taken out by a foreigner to use naphthaline, and that the product that he makes from his patent is worth not less than $100 a ton?

Mr. Allen—I was not aware of that. I do not suppose that gas companies intend going into the business of making naphthaline and tar. I go upon this principle: I do not bring into the yard anything that is not made into gas. We have nothing to sell. We talk about selling the coke, and talk about selling tar. I don't suppose that gas men are going into any business except that of making gas.

Major Dresser—Do you receive your naphtha on tank cars?

Mr. Allen—Yes; it is pumped up into the tank out of the cars.

Major Dresser—You pay for the naphtha according to the gauge of the tank car?

Mr. Allen—We buy it as it comes in the tank car.

Major Dresser—Can you tell us the loss by evaporation or leakage on measuring out the oil from your tanks into your works, and the loss in transportation on naphtha?

Mr. Allen—No, I cannot. I have not the figures with me, and I cannot state the fact in that regard. We have a gauged tank in the gas works, and we use it.

Mr. Page—Have you had an explosion of naphtha?

Mr. Allen—No, sir. We had a measuring tank in a corner of the retort house; it was a large tank; there was a closed tube, and the men were charged never to turn their backs on it until the gauge tank was full. The man who tended it, a good and faithful man, left it open this summer. The tank is the usual distance from the furnace. The man left the faucet open, and the naphtha ran from there, took fire, and ran right up over the gauge. It ran out and made an intense heat which warped the iron of the roof and drew the iron rods out, and brought the roof down at that end. At any rate, the authorities inquired into it, and sent a committee down to our works to investigate. They reported that there was not as much danger from our tank there as there was from a single barrel of naphtha kept in a drug store in the main street.

Mr. Forstall—How do you vaporize your naphtha—by the ordinary steam heat?

Mr. Allen—Yes; it is vaporized by steam.

Mr. Forstall—Does the steam reduce all but one per cent. of the oil into vapor?

Mr. Allen -It does; it passes into the retort. We have no residuum at all.

Mr. Littlehales—Have you any formation of carbon in your retorts?

Mr. Allen—No, sir.

Mr. Sherman—What kind of coal do you use?

Mr. Allen—Anthracite.

Mr. Sherman—How many thousand feet do you put into your holders per ton of coal?

Mr. Allen—I have not figured that up, but if Mr. Harris were here he could probably give you the figures. I should have been able to do so had I supposed the discussion would have taken this turn. I only rose to speak upon general principles of the difference between the processes of coal gas and water gas. I did not get up to speak about our particular process.

Then with regard to the use of water gas for heating purposes, I would say that the expense of purifying for heating purposes is not necessary at all; therefore, it is produced very cheap, and for heating purposes would be of great advantage.

Mr. Price—Wouldn't it be necessary, in making gas for heating purposes, to have a double set of pipes?

Mr. Allen—Yes, sir.

Mr. Price—And another holder?

Mr. Allen—Yes, sir.

Mr. Price—And it would be also necessary to have separate bills for the gas you would sell at different prices?

Mr. Allen—Yes.

Mr. Price—I would like to inquire whether you still superheat your steam?

Mr. Allen—Yes; we superheat it, and send it into the retort as dry as steam can be made.

Mr. Starr—What is the effect upon your meters? I have seen meters where they have been working the oil process which have dried up and have leaked badly.

Mr. Allen—That all comes from an improper system of making gas. I have seen works where they made water gas, and have heard of it at different places where water gas is imperfectly made, where there is a gummy substance or an oily substance carried forward in the burners, but that is because the gas has not been properly made.

Mr. Starr—With your process, if there is any mistake in the manufacturing, will careless manufacturing produce the same result?

Mr. Allen—We can make it poor. There is no necessity, however, for making it poor. If you send in more oil than the hydrogen will take up you will undoubtedly have a residuum; but our system is so perfect that the most ordinary hired men running the works know what to do. Unskilled labor will run it without the least trouble. Both Mr. Harris and myself are very seldom there. But the men can tell just the quantity which wants to be run. We have, however, a jet photometer in the office, and if it is running too low, we will tell them of it, and they will turn it on a little more. If it is running too high they will shut it off.

The Secretary—How many men do you employ?

Mr. Allen—We employ two in the day and two in the night, and they can make about 100,000 feet. We send out but 60,000 or 70,000 feet, and the same labor and the same force can just as well make 100,000 feet.

Mr. Starr—Suppose you wanted to make only 25,000 feet, would you still have to have four men?

Mr. Allen—No, sir; two men will attend to six benches.

Mr. Starr—You can make 50,000 with two men.

Mr. Allen—It takes just as much force to make 50,000 as it would 100,000.

Mr. Littlehales—I move that the thanks of the Association be tendered to Mr. Allen for the very clear manner in which he has expressed his views in this discussion. I never have heard expressed, in so clear a manner before, the relations of hydrogen and carbon to gas making; and I think that every member of the Association has been benefitted by Mr. Allen's remarks.

Carried.

The Secretary read a letter from Mr. J. D. Patton, with reference to his paper presented at the Cincinnati meeting; and it was moved and seconded that the paper be published with the proceedings of this meeting.

Carried.

The paper was as follows:

ON REGULATION OF PRICES.

I have for a long time been deeply impressed with a belief that every consideration of security and advancement of the various manufacturing interests demands the general establishment of a lower range of prices for gas light.

In a paper read at the meeting of this Association in 1875, this view was expressed in the following words:

"Your consideration of this matter involves not so much the advancement of your position as the holding of it. The position of all large and well-managed gas companies is, financially, as good as they can hope to make it. They cannot well increase their percentage of profit without eliciting public clamor and opposition, and the advantages they can expect from improved methods of gas making are in the line of such improvements as will enable them to furnish a cheaper light to their consumers."

The average prices charged for gas to-day are practically the same as they were years ago, when the only competition was with high-priced oils and the execrable tallow dip.

The immense production of petroleum, and the very low prices at which it is sold, have enabled it to drive these competitors from the field, and to encroach very seriously upon the gas consumption.

This competition with petroleum in some of its various forms—kerosene, gas, or gasoline—has been felt by nearly every gas company in the country, and in many of these instances the situation is serious.

A general readjustment of prices two or three years since, when the need of such action first became apparent, would, in my opinion, among other benefits, have saved some of the gas companies from the equally disagreeable alternatives of crushing out or buying up opposition works.

The prevalence of opposition gas schemes, at this time is, doubtless, in great part, due to a very general, but not very harmonious, belief that the prices charged by the gas companies are exorbitant, and that the established gas companies cannot manufacture gas at prices as low as the various plans for manufacturing an imitation of their product can work.

The fact, so sedulously kept from public knowledge, that the actual cost of manufacturing coal gas, and delivering it into the gasholder, is but a fraction of the price usually charged for it, is known to but very few persons outside of the business; and one result of this ignorance is the general belief (before referred to) that gas can be made in larger quantities and vastly cheaper by other methods: and hence, in part at least, the readiness of a too credulous public to invest money in opposition works, and to enter into a contest, the possible magnitude of which they do not dream of, and into which they would be less likely to enter were they aware of the real facts of the case.

The opportunities thus afforded have been improved by speculators in many of our larger cities, and the way will be none the less easy for them to travel as long as gas manufacturers insist upon prices not warranted by the the cost of production, and regardless of the demands of competition.

I am aware that many of the gas companies think they cannot reduce prices without loss of dividends. But is this really the case?

It may seem to a corporation doing business upon a greatly exaggerated stock value, and requiring more than one-half of all its present revenues to meet its dividends, especially when these revenues are diminishing, and are subject to a heavy leakage and repairs account, that a reduction in price of gas would be disastrous, and to those companies working on better bases it might seem very undesirable. Were there no compensations for such reductions, the excuse we "cannot afford it" might be valid.

But there is no gas consuming community in this country where a reduction from a high price for gas to a satisfactory one, would not be followed by some increase both in the amount consumed by present consumers and inthe number of consumers. This increase might not at first return more than a portion of the loss by the reduction of price; but in some instances that I have known it has fully replaced the amount.

And, on the other hand, it is easy to instance gas companies who, by their endeavor to maintain prices, have thus lost valuable consumers, and invited opposition, and, after all, have been compelled to make greater reductions than were at first necessary.

When the competition was between gas (even at four dollars per 1000 and sperm oil at a dollar and a-half per gallon, gas was the cheaper light.

But with kerosene at twenty cents per gallon the position is completely reversed, and gas is compelled to reckon the value of all its advantages.

The simple illuminating value of a thousand feet of gas is equal to about that of three gallons of kerosene; and if we add to the cost of these three gallons an equal sum for trouble, care, and repairs of lamps, it is still economically equal to gas light at $1.20 per 1,000.

Were there no other considerations in the matter beyond the single question of present economy, gas must either be sold at about that price or retire from the contest.

Fortunately, however, safety and luxury have market value, and these coupled with the prevalent desire to use good things, represent the main value of gas light over that of oil. As a question of dollars and cents, how much is it?

If, in the public estimation, this additional value is equal to eighty cents per thousand, they will buy gas from us at $2.00 per thousand. If the public thinks safety and comfort worth $1.30 or $1.80 per thousand (meter measure) they will pay $2.50 or $3 per thousand for gas rather than use kerosene.

As a means of meeting the competition of kerosene I do not think the desirability of a moderate price for gas can be overestimated. And as regards the establishment of opposition works, money is required to build them, and that money is rarely furnished by communities who have even an approximate idea of the resources of the present holders of the position, and whose feelings have not been rendered hostile by real or supposed wrongs and over charges.

The frauds that have been practiced in the organization of opposition companies have been deep and shameful. In one instance, that would have been more notable had not the old company made early and decisive and public preparations for war, the money of people who were ill able to lose it was captured by the aid of a flaming prospectus, promising an annual profit far greater than the whole annual consumption of gas in the town, And even after this, and after the pipes were laid and generators were built, no attempt was made to supply the confiding public with a better and a cheaper gas, or to make any returns from the works, lest the competition should serve as a centennial warning instead of a centennial advertisement.

Believing that you all appreciate the importance of a proper regulation of prices, so that they may produce the greatest possible gross revenue, and that business liberality is as likely to be successful in gas manufacture and sale as in any other business, I will not trespass further on the time of the Association.

Mr. Cartwright—Before we finally adjourn I wish to make a motion which I hope will be very heartily responded to. We have been profuse in tendering our thanks for everything pertaining to this Association; but I think we have omitted one very important duty in this direction, that is to tender our thanks to the gentlemen who threw himself into the breech four or five years ago in a position that required just such energy, and just such integrity, and just force as he has shown himself to be possessed of. I, therefore, propose that the Association tender to Mr. Nettleton its most sincere thanks for the manner in which he has discharged the duties of Secretary during the years that he has filled that position. I think it is eminently proper that this expression on our part should be given, and hope that it will be given as freely as any other vote of thanks that has been given today. [Applause.]

The President—It has not fallen to my lot to present before you a motion which more entirely accords with my own feeling than the motion of Mr. Cartwright. I should vote for it with half-a-dozen hands if I had them.

Mr. Neal—I move that we take a rising vote.

A rising vote of thanks was then tendered to Mr. Nettleton.

The Secretary—I must be permitted to say a few words even at this late hour. It has been most gratifying to me to listen to the kind sentiments that have been expressed. Such sentiments, expressed in the generous manner that these have been, warm and refresh the better side of human nature, and are a compensation for my several years of service as your secretary and treasurer far above money value. It is a compensation bright, cheerful, continuous, and will run with me as a part of my existence through all the rest of the years of my life. I have another satisfaction, personal to myself, inherent in my own consciousness—that is, that I have done my best to serve you, as your secretary and treasurer for the last five years, and now looking back over the field with the present knowledge of what was desirable to be done, if I were called upon to execute the duties of those offices for the same term of years again, I could not improve much on the past.

I thank you, gentlemen; I thank the officers and all the members of the Association for their kindness and courtesy during my several terms of office. I thank them for the manner in which they have sustained and aided my efforts to make the American Gas Light Association a strong and prosperous institution.

It has been suggested that the present strength and prosperity of our Association was the result of the efforts of your secretary and treasurer. I cannot accept an award of praise so broad, general and exclusive as that. No Secretary of an association, kindred in nature to the American Gas Light Association, can of himself create a successful Association; he must have the aid and assistance of the members of the association, or his efforts, however zealous, however discreet, will fail in their results.

Many of you have worked sincerely, with great earnestness and with persistence, for the welfare and interest of the Association. I must mention the American Gas Light Journal, and its Editor, Major Dresser. He has performed arduous and most persisient service for the benefit of the Association. To him, both individually and as Editor of the Journal, the Association and its members are largely indebted for its present prosperous and highly gratifying condition.

I hope at future meetings, as a private soldier in the ranks, to have the privilege of taking part in the deliberations and discussions. For the last five years this privilege has been denied me by the exacting duties of the offices of Secretary and Treasurer.

In closing, permit me to express the wish that in future years the American Gas Light Association may have a growth and prosperity which shall be its manhood. to which its present condition, by comparison, is only its youth. To you. the members of the Association, I wish you all happiness, and "may you live long and prosper." [Applause.]

On motion of Mr. Cartwright, the Association adjourned, *sine die*.

The Waste of Energy in Producing Gas From Water.*

By Eugene Vanderpool, M.A., C.E.

Other things being equal, it is a question of time and experience for any process for the manufacture of gas that is more wasteful or economical in utilizing the potential or theoretical energy of coal than another, to be adopted or cast aside. Capital may for a time carry on with apparent prosperity undertakings that are founded upon unscientific bases, but it is a question of time only when these undertakings fail.

The decomposition of water by means of incandescent carbon was accomplished in the year 1793 by Lavoisier, and since then much time, energy, money, and intelligence have been devoted to the problem of making water gas economically, as compared with gas made from bituminous coal. This problem has not yet been so solved that the solution has been accepted by those qualified to judge of its success; and it is difficult to see how it can be, where the supply of bituminous coal is abundant, and where there is a fair demand for the residuals of the coal gas manufacture. Broadly, it may be stated that water is but the ashes of combustion, and the problem is to imbue with energy a material that must obtain whatever energy it possesses in a gaseous form from other sources. In obtaining this energy it is evident there must be a loss, and this loss has hitherto prevented the numerous experiments for producing gas from water, where carried out on a large scale, from being other than commercial failures. In the manufacture of water gas that process is the most economical and successful, all things considered, that produces the largest quantity of gas from the smallest weight of coal. All of the retort processes, when the distillation or decomposition has been produced in the ordinary coal gas retort, have been wasteful of coal, and have, from the thin beds of incandescent coal used, produced an excess of carbonic acid—a gas that the economical maker of water gas desires to have as little of as possible.

Water gas is most economically produced where equal quantities of hydrogen and carbonic oxide are obtained from the combination between the water and carbon. The process of Messrs John and Thomas Nesham Kirkman, patented in 1852, is so far the best for the economical production of water gas. In minor details it has of late years been improved on, but substantially gas can be made as cheaply by the Kirkman process as by any now in use. It is worthy of remark that the Kirkman process can be used by any one desirous of making water gas without expense for the use of patent, royalty, etc. The following is a description of part of the Kirkman claim:

"Improvements in the manufacture of gas for lighting and heating—consisting, first in the mode of obtaining gas by decomposition of water in close furnaces. The furnace in this case can be closed and rendered airtight. Over the furnace, and heated by it, is a tubular boiler, containing water for the generation of steam. A regulated supply of hot air is forced into the furnace through the ashpit, and the temperature of the furnace raised to the melting point of iron. A regulated quantity of steam is then also introduced near the bottom of the furnace. The resulting gases arising from this mode of internal combustion are caused to pass, first, through the tubes of the boiler, where they part with some heat to the water, then through tubes in a iron cnamber, where they part with more heat to the air in the chamber. The air in this chamber is being forced through by a blowing machine, and is on its way to the furnace, and is thereby heated before it enters the furnace. The mixed gases are then passed to the condenser, purifiers, and gasholder, and may be employed in this state for the purpose

* A paper read before the Society Gas Lighting at a meeting held Oct. 9, 1879.

of heating; or, if carburetted by naphtha or other fluid hydrocarbons, may be used for lighting purposes."

The name of the patentee of the above process is commonly known as Kirkham, although in the English edition of Patents for Inventions, printed by order of the Commissioner of Patents, it is Kirkman. It was the gas made by this process that was condemned and abandoned in France on account of its containing from 30 to 40 per cent. of the extremely poisonous carbonic oxide gas, the production of which dangerous gas, in large quantities, is inevitable in making water gas economically. It will be noticed that the gas obtained by the Kirkham process, if the manufacture was carried out precisely as stated in the specifications, would contain a larger per centage of nitrogen than usually is found in water gas. But this method of working the apparatus is not at all necessary; and, indeed, the gas practically produced by this process, judging from the analyses made by Regnault, was ordinary water gas. But, if any of us desire to manufacture water gas, there are many processes to choose from. There is the process of M. Gillard, in use, and abandoned twenty years ago, described in "A Treatise of Gas Works," by Samuel Hughes, C.E, as follows:

"With the view of obtaining hydrogen more economically, M. Gillard erected a cupola similar to those in iron foundries; this was filled with coke or charcoal, ignited, and the fuel brought to a state of incandescence by a fan or blower; after which (all passage to or from the atmosphere being closed) steam was admitted at the lower part, and, passing through the volume of fuel, was decomposed, when the hydrogen and carbonic acid with which it was impregnated were withdrawn by an exhauster from the upper part of the cupola. From time to time the supply of steam ceased, and air was furnished by the blower as before, to bring the fuel to a proper degree of temperature for the decomposition.

"This plan, though much more economical than the retort system, did not succeed; the expense of manufacture was still very excessive."

It is not necessary to call your attention to any more of these old processes. It is well, sometimes, however, to remember that there is little that is new under the sun.

The Quantity of Carbon and Water Required to Produce 1000 *Cubic Feet of Water Gas, Theoretically.*

To produce 1000 cubic feet of water gas—no account being taken of the fuel required to make the steam and heat the retorts—consisting of 500 cubic feet of hydrogen and 500 cubic feet of carbonic oxide, there is required, theoretically, 24 pounds of water, which becomes decomposed into 500 cubic feet of hydrogen, weighing 2.66 pounds, and 250 cubic feet of oxygen, weighing 21.34 pounds; 16 pounds of carbon, producing 500 cubic feet of carbon vapor, that combines with the 250 cubic feet of oxygen, and produces 500 cubic feet of carbonic oxide. We have 24 pounds of water and 16 pounds carbon, 40 pounds in all, producing 1,000 cubic feet of gas, 500 cubic feet of which is carbonic oxide. Said gas weighs 40 pounds. making a specific gravity of 0.531. The quantity of coal required to furnish the heat to produce this gas would be as follows: In making the following calculation certain data have to be taken, and for the water gas we require the potential energy of anthracite coal, which is about as follows: Anthracite coal of good quality has about the following composition:

Carbon	90.45
Oxygen and nitrogen	2.45
Hydrogen	2.43
Ash	4.67
	100.00
Specific gravity	1.460

The potential energy of which is about 13,000 heat units, but the energy utilized in practice cannot be taken at over 6,000 heat units.

To convert the 24 pounds of water at a temperature of 60°F. into steam of 100 lbs. pressure would require $24 \times 1153.4 = 27681.6$ heat units, to generate which would require $\frac{27681\ 6}{13{,}000} = 2.13$ pounds of anthracite coal. To heat the carbon and keep it at a temperature sufficiently elevated to produce the dissociation of the water would require—

For the hydrogen, $2.66 \times 62500 =$		166250 heat units
Less combination between C. & O. $= 16 \times 4450 = 71200$.		
Less heat furnished by steam	27681	
		98881 "
Balance,		67369 "

and $\frac{67369}{13000} = 5.18$ pounds anthracite coal.

The temperature at which the dissociation of water takes place being 2192°F., according to St. Claire Deville, the gas leaving the generator at this temperature, unless there be some method of utilizing the heat, carries off in heat, the temperature of gas at holder being 60°F., as follows:

Hydrogen 2.66 (specific heat 3.4046) $\times$ 2132 =	19307 heat units.
Carbonic oxide, 37.34 (specific heat .2479) $\times$ 2132 =	19734 "
Total	39041 "

which would require $\frac{39041}{13000} = 3.00$ pounds of anthracite coal.

Therefore we have for the production of 1000 cubic feet of water gas, consisting of equal volumes of hydrogen and carbonic oxide, the following:

Pounds of Anthracite Coal Required by Theory.

Pure carbon for dissociation of water 16 pounds	18.00	pounds.
Anthracite coal to evaporate water	2.13	"
" " to heat carbon	5.18	"
" " to heat escaping gases	3.00	"
Total	28.31	"

Or, theoretically, 28.31 pounds of anthracite coal should produce 1000 cubic feet of water gas.

Practice Compared with Theory in the Manufacture of Water Gas.

But, as the practical efficiency of the very best steam engines of large size, with the closest attention, is not more than 10 per cent. of the theoretical energy of their fuel, so, in the manufacture of water gas, there is a great deal more energy required than is indicated by theory. In the first place, a gas composed equally of hydrogen and carbonic oxide is never obtained; there is a great loss by intermittent action in working the apparatus, from radiation and other sources.

In the manufacture of water gas by the Kirkman process, or that most largely used in this country, a greater quantity of water has to be used than is indicated by theory.

A large quantity of steam passes the generator undecomposed, so that in some methods no less than 100 pounds of water have had to be evaporated per thousand cubic feet of gas made. Fifty pounds is a low estimate. To convert this water at a temperature of 60° F. into steam of 100 pounds pressure, requires practically $\frac{50 \times 1153.4}{6000} = 9.61$ pounds of anthracite coal.

There is required of carbon in the generator, in the shape of anthracite coal, for the decomposition of the steam, 20 pounds per thousand cubic feet.

To heat the carbon and keep it at a temperature sufficiently elevated to produce the dissociation of the water requires—

For the hydrogen, $2.66 \times 62500 =$		166,250 heat units.
Less for combination of C and O, $16 \times 4450 =$	71,200	
Heat furnished by steam, $50 \times 1153.4 =$	57,670	
		128,870 heat units.
Balance		37,380 heat units.

Required in anthracite coal,

$\frac{37{,}380}{6000} = 6.23$ pounds.

Loss by gas leaving generator, 39,041 heat units, as above

Required in anthracite coal,

$\frac{39{,}041}{6000} = 6.50$ pounds.

Loss by excess of steam not decomposed,

$26 \times (2132 - 1153.4) \times$ (specific heat of steam .475) = .. 11,084.8 heat units.

Required in anthracite coal,

$\frac{11{,}084.8}{6000} = 1.85$ pounds.

Recapitulation of Anthracite Coal Practically Required to Produce 1000 *Cubic Feet of Water Gas.*

Steam	9.61	pounds of	anthracite	coal.
Carbon	20.00	"	"	"
Heat in gasogene	6.23	"	"	"
Loss by gas	6.50	"	"	"
Loss by steam	1.85	"	"	"
Total	44.19	"	"	"

So that, with an apparatus properly erected and manipulated, and constant in its action (which none of the cupola processes are), it would be possible to produce 1000 cubic feet of water gas with an expenditure of 44.19 pounds of anthracite coal. But in the cupola process the production is necessarily inconstant; in blowing vast quantities of air for alternate 15 minutes through a mass of coal varying in its heat from 1000° F., or less, up to 2000° F., there must of necessity be a great waste of fuel in getting

this mass up to and above 2500° F. Then, again, when the steam is let on the cooling must also be irregular, so that at the time of ending the steam blast the quantity of undecomposed steam, and, consequently, wasted energy, both of the steam boilers and the generator, must be large; and, indeed, experience shows that with care and expensive plant, from 75 to 100 pounds of anthracite coal are required to produce 1000 cubic feet of water gas by the cupola process.

Again, a gas composed of equal parts of hydrogen and carbonic oxide is never obtained, there being present a percentrge of CO_2 and N, which represents another waste of energy. A gas is obtained from the gasogene on the average of about the following composition:

Hydrogen	55
Carbonic oxide	35
Carbonic acid	5
Nitrogen and sundries	5
	100

Composition of the water gas obtained in ordinary work by the cupola process.

An analysis of the water gas of the Municipal Gas Light Co., made by Prof. Henry Wurtz, Ph.D., March 4, 1878, is as follows (specific gravity of gas, .4912):

Composition of the Water Gas of the Municipal Gas Light Company.

Hydrogen	49.32
Marsh gas	7.65
Carbonic oxide	37.97
Carbonic acid	0.14
Nitrogen	4.79
Oxygen	0.13
	100.00

This gas contains an unusually small quantity of CO_2, and may have been taken after a purification by lime.

An analysis of the Commercial Gas is as follows:

Analysis of the Commercial Gas of the Municipal Gas Light Company.

Hydrogen	38.20
Marsh gas	15.82
Carbonic oxide	27.14
Carbonic acid	0.10
Oxygen	0.10
Nitrogen	3.35
Olefines	9.29
Paraffines	6.00
	100.00

Specific gravity, .6844.

The report containing these analyses may be found in the *Journal of Gas Lighting*, May 7, 1878.

The Potential Energy of Water Gas.

The potential energy of water gas is somewhat over 300 heat units per cubic foot.

In experiments made at Mount Vernon, N. Y., with water and coal gas, it was found that one cubic foot of coal gas would generate more than twice the heat of one cubic foot of water gas.

These figures are confirmed by the examinations of Mr. Sarnstrom of the calorific values of water gas made by the Strong process, a report of which is given in the *Engineering and Mining Journal*, August 30, 1879, page 142. The following figures of relative calorific values, which have been arrived at by Mr. Sarnstrom from the experiments referred to, are very instructive and suggestive:

100.00 cubic feet of Siemens' gas from coke equal in calorific value
64.60 " " " peat; or
59.80 " " " Hoganas coal; or
39.18 " " strong water gas.
17.75 " " coal gas (illuminating).

So that one cubic foot of coal gas is equal in energy to $\frac{39.18}{17.75}=2.20$ cubic feet of water gas. Now, if we assume that the potential, or theoretical, energy of these gases vary in the same proportion as their net or practical energy, we get the theorecica energy of one cubic foot of water gas (that of coal gas being 660), as $\frac{660}{2.2}$ 300 units.

Experiments confirming these results have recently been made by Aug. Th. Schuesaler, Ph.D., and myself. A gas was made consisting of

Hydrogen	65 per cent.
Carbonic oxide	35 "

One and sixty-five hundredths cubic feet of this gas heated 2.75 pounds of water from 68° F. up to 150° F., developing, therefore, in practical work,

$$82\times2.75=225.50 \text{ heat units.}$$

and, consequently, each cubic foot developed an energy of

$$\frac{225.50\times1}{1.65}=136.6 \text{ heat units.}$$

The 2.75 pounds of water was heated from 68° F. up to 150° by 0.709 cubic foot of our ordinary 16-candle coal gas, which developed, therefore, an energy of

$$82\times2.75=225.50 \text{ heat units;}$$

consequently each cubic foot developed an energy of

$$\frac{225.50\times1}{.709}=318 \text{ heat units.}$$

It follows, therefore, that, practically, one cubic foot of coal gas is equal in energy to

$$\frac{318}{136.6}=2.32 \text{ cubic feet of water gas.}$$

These experiments were made with the two gases under identical conditions as to loss of energy by radiation, etc., and they may be taken as practically reliable.

The Potential Energy of Coal (Illuminating) Gas.

The potential energy of coal gas is taken as the average of the results obtained by several independent investigators. In the Traité de la Chaleur, par Péclet, edition 1878, vol. 1, pp. 116, 117, is given the analysis of the gas of the Paris Gas Company, and its calculated calorific power. The analysis made by M. Hudelo is—

	By Volume.	By Weight.
Nitrogen	2.7	6.7
Oxygen	0.5	1.4
Carbonic acid	1.5	5.8
Hydrogen	50.1	8.8
Carbonic oxide	6.3	15.6
Marsh gas	33.1	47.3
Olefiant gas	5.8	14.4
	100.0	100.0

Specific gravity, 0.400.

The calorific power of this gas is—

$$P=0.088\times34{,}462+0.156\times2403+0.473\times13{,}063+0.144\times11{,}857=11{,}293$$

and, making certain reductions,

2.205 pounds of this gas are equal to 10,269 calories; or,
73.11 cubic feet are equal to 40,747 heat units; or,
1 cubic foot is equal to 557 heat units.

M. Morin makes 1 cubic foot equal to 696 heat units; Dr. Letheby, 650 and 750; Mr. F. J. Evans, 650; Mr. Goddard, 652.

We are now prepared to show the waste of energy.

Waste of Energy in the Production of Water Gas, based upon the Consumption of 100 *Pounds of Anthracite Coal per* 1000 *Cubic Feet of Gas Generated.*

Assuming that 100 pounds of anthracite coal is required to produce 1000 cubic feet of water gas:

The theoretical energy of 100 lbs. of anthracite coal is	$100\times13{,}000=1{,}300{,}000$
The theoretical energy of 1000 cubic feet of water gas is	$1000\times300=300{,}000$
Waste of energy	1,000,000
Percentage of energy utilized	$\frac{300{,}000}{1{,}300{,}000}=23.07$
Percentage of energy wasted	$\frac{1{,}000{,}000}{1{,}300{,}000}=76.93$

We have data that show, under the most careful working, 1000 cubic feet of water gas have been produced from 75 pounds of anthracite coal, and we will assume this as the best work obtainable in practice, and take it as a basis of comparison, so as to give the water gas process every favor in working results.

Waste of Energy, based upon the Consumption of 75 *Pounds of Anthracite Coal per* 1000 *Cubic Feet of Water Gas Generated.*

The waste of energy would then be as follows:

The energy of 75 pounds of anthracite coal is	975,000 heat units.
The energy of 1000 cubic feet of water gas is	300,000 "
The waste of energy is	675,000 "

Or the

Percentage of energy utilized is $\frac{300,000}{975,000}=30.7$

Percentage of energy wasted is $\frac{675,000}{975,000}=69.3$

100.0

We will now compare with this the energy theoretically and practically required to produce 1000 cubic feet of illuminating gas from coal, the water gas being a non-luminous gas.

As in the case of the manufacture of water gas we have taken the results obtained from the best practice for a comparison, so in the manufacture of gas from bituminous coal we will take for our basis a specimen of excellent work.

The following represents, nearly, the composition of our best caking coals :

Carbon	81.81
Hydrogen	6.00
Nitrogen	1.28
Sulphur	1.69
Oxygen	2.58
Ash	6.64
	100.00

and a coal of the above composition has a potential energy of about 14,000 heat units.

One ton of such a coal, properly carbonized, will produce—

Products of One Ton of Bituminous Coal Distilled for Illuminating Gas.

11,200 cubic feet of 16-candle gas, weighing	375.00	pounds.
Weight of tar	101.00	"
Weight of liquor	110.00	"
Impurities, SH_2	7.00	"
" CO_2	31.00	"
Ammonia	2.50	"
	626.50	
And 1,560 pounds of coke	1,560.00	"
Leaving a loss of	53.50	"
Making total weight	2,240.00	"

Energy Required for the Distillation of One Ton of Bituminous Coal.

To produce this gas there would be required, theoretically, taking the specific heat of coal at .25, the gas at .30, and assuming that the coal has to be raised from 60° F. to 2500° F., and that the gas escaping by the standpipes has a temperature of 150°,

$2240\times(2500-60)\times0.25+11,200\times(150-60)\times0.30=1,668,800$ heat units.

The coke yielding per pound $12,906\times85=10,970$ units of heat, there would be required $\frac{1,668,800}{10,970}=152$ pounds of coke, or 9.8 per cent. of the coke produced. So that, theoretically, we have one ton of coal, having a potential energy of 31,360,000 heat units, carbonized with the following waste:

Theoretical Wast of Energy in Carbonizing One Ton of Bituminous Coal.

Energy of 1 ton, $2240\times14,000=$		31,360,000 heat units.
11,200 c. ft. gas, with an energy of $\times660=$	7,392,000	
101 lbs. of tar, with an energy of $\times21,000=$	2,121,000	
1560–152 lbs. of coke $\times10,970=$	15,345,790	
		24,858,760 heat units.
Waste of energy		6,501,240 heat units.

$\frac{6,501,240}{31,360,000}=20.7$ per cent., which is represented by the impurities, ammonia, liquor, and waste by leakage, etc., although the coke may not be credited with all the energy it possesses. It is worthy of remark that the ammoniacal residuals are valuable, and in an estimate made upon a commercial basis would reduce the percentage of waste. In the production of coal gas with a good setting of the retorts, and by the use of the gas furnace, one ton of coal can be carbonized by the use of 20 per cent., or 312 pounds of the coke produced. It is said that in some of the complicated settings of clay and iron retorts the carbonization has been effected by 15 per cent. of the coke produced.

The present extended use of the gas furnace in France and Germany, and the excellent results obtained therefrom, seem to indicate that here is the weak point in our system of carbonization, and that for large yields, low cost of labor, and increased percentage of coke sales, we must adopt this system of generating our heat. Although in the conversion of the solid fuel into a gas there is a waste of energy of more than 30 per cent., still this waste is more than compensated for by the efficacy of the gas.

The application of the gas furnace to an ordinary French boiler at the iron works of M. Muller, at Ivry, showed that before the application the boiler was evaporating six pounds of water per pound of coal, which is very good work, and afterward evaporated from 8.60 to 9.20 pounds per pound of coal —an average of 8.90 pounds. This is an increase in evaporating efficiency of 48 per cent., or an economy of 32 per cent. for equal quantities of water. A description of this boiler will be found in D. K. Clark's "Fuel: Its Combustion and Economy."

In the practical carbonization of bituminous coal we have, therefore,

Waste of Energy in the Carbonization of Bituminous Coal for the Production of Illuminating Gas.

One ton of coal, with a potential energy of		31,360,000 heat units.
11,200 c. ft. gas, with an energy of $\times660=$	7,392,000	
101 pounds tar, with an energy of $\times21,000=$	2,121,000	
$(1560-312)\times10,970=$	13,690,720	
		23,203,720 heat units.
Being waste of energy		8,156,280 heat units.

and we have

Percentage of energy utilized $\frac{23,203,720}{31,360,000}=73.9$ per cent.

Percentage of energy wasted $\frac{8,156,280}{31,360,000}=26.1$ per cent.

Comparative Energy, in the shape of Gas, Derived from the Pound of Coal by the two Methods.

So that we have one pound of coal, in the shape of water gas, giving, in its changed condition, a potential energy of

$$\frac{300,000}{75}=4,000 \text{ heat units.}$$

Whereas one pound of coal, in the shape of coal gas, tar, and coke, the gas having also an illuminating value, gives, in its changed condition, a potential energy of

$$\frac{23,203,720}{2,240}=10,360 \text{ heat units;}$$

or one pound of coal, in the changed condition of coal gas, tar, and coke, goes $\frac{10,360}{4000}=2.59$ times as far as the pound of coal in the water gas.

If the question of the relative waste of energy of the two methods of gas making determined also the question of comparative economy, it is evident that one pound of coal in the shape of coal gas goes twice as far as one pound of coal in the shape of water gas, and that the latter is more expensive; and, moreover, to add still further to the comparative commercial value of the coal gas method, we have a good illuminating gas, and the residual ammoniacal liquor. To make the above calculations of practical value it is necessary to look at the comparative waste of energy in the two methods from a financial point.

We will take the following data as a basis, assuming that in the near future the price of coal, oil, coke, etc., will reach a point where there is a fair profit to those producing them. There can scarcely be a question that within a few months anthracite coal, though now selling at $2,50 per ton, will advance to $4 or $5 a ton; but we will take as the normal price of anthracite coal that usually addopted in making engineering estimates in this vicinity, viz., $4.50 per ton. We will also take $5.50 per ton as the price of bituminous coal, thinking this a fairly remunerative one to producers and carriers, and this seems to be a price fixed somewhat by the great supply, both at home and abroad. We will also take the price of coke at 8 cents per bushel, assuming it to be determined by the price of anthracite coal, although when anthracite coal sells at $5 per ton we find no difficulty in disposing of our coke at 10 cents per bushel. The tar we could use as a fuel, assuming that 101 pounds are equal to 202 pounds of coke; but we will take the 101 pounds of tar per ton as sold for 25 cents. We will take the price of naphtha at 5 cents per gallon, the yield to be 60 cubic feet of 60-candle gas, or 3,600 candle-feet per gallon. We will also consider that in the manufacture of water gas, and its enrichment by naphtha, the naphtha gas does not increase the volume of the two gases in proportion to the quantity of naphtha used. This must be accounted for by the molecular construction of the several gases, in the same way that a glass globe exhausted of air, under constant pressure and temperature, can be filled with the vapor of water, and there is still room for the globe full of alcohol vapor, and then there is still room for the globe full of ether vapor—and we might go still further. But it is certain that the globe will contain all of these bodies, under nearly the same conditions, as if each were the sole

occupant of the space. The weight is increased, but not proportionally the volume. We can ascertain nearly what the increased volume of the gas is by calculation from the increased weight. The weight of the water gas being, S. G., .494=263.39 grains per cubic foot, and the commercial gas being S. G., .684=365.94 grains per cubic foot, the difference, 102.55 grains per cubic foot, must be derived from the naphtha, and whatever naphtha per cubic foot is used in addition must go toward increasing the volume So that if, on the average, 5.57 gallons of naphtha, weighing 32.02 pounds, per thousand cubic feet of commercial gas, are used to make a luminous gas of the water gas, and if of this 14.66 pounds go toward adding to its weight, it is evident that (32.02—14.66)=17.36 pounds of the naphtha must constitute a part of the gas produced, this being equal to $\frac{17.36}{5.75} \times 60 = 180.60$ cubic feet; or, in other words, it would seem where as large a quantity as 5.57 gallons of naphtha per thousand cubic feet of commercial gas is used this must constitute of the volume $\frac{1180.6 - 1000}{1180.6} = 15.3$ per cent. It seems that the illuminating power of such a gas, perhaps from the destructive effect of the water gas upon the illuminants, is not as high as would be supposed, and is, *when tested in the same burner as the coal gas under consideration*, but little over 17-candle power. In comparing, financially, the two processes, so as to give the water gas every favor, we will assume that the full illuminating value of the naphtha is obtained, and that 5 gallons of naphtha converted into gas, with the water gas, will give a mixture of 1144 cubic feet of 16-candle gas.

We will consider, in estimating the cost of producing 1000 cubic feet of 16-candle gas by the two methods, only those items that are not identical in cost for each gas; for instance, the expense of superintendence, office expenses, taxes, wear and tear, distribution, interest, etc., *the great items of expense*, are the same for both gases. We will consider the material and labor only. We have—

The cost of 1144 cubic feet of 16-candle gas:

1. Anthracite, 75 lbs., at $4.50 per ton	15.1 cents.
2. Naphtha, 5 gallons, at 5c	25.0 "
3. Coke, for vaporizing, fixing oil and water gas, rate of ½ bushel per M feet	4.0 "
4. Cost for labor	8.0 "
5. Cost for lime	1.5 "
6. Cost of water	2.0 "
Total	55.6 "

Cost per M, $\frac{55.6}{1144} = 48.6$ cents.

And we have

The cost of 11,200 cubic feet of 16-candle gas:

1. One ton of coal		$5.50
2. Cost for labor		1.12
3. Purification		0.23
4. Cost for water		0.03
Total		$6.88
Less residuals—		
1. Coke, 42, less 25 per cent.=31.5 bushels, at 8c	$2.52	
2. Tar (this could be used more advantageously as a fuel, but we will take it as sold)	0.25	
3. Ammoniacal liquor	0.10	
		2.87
Net cost being		$4.01

Cost per M, $\frac{4.01}{11,200} = 35.8$ cents.

N. B.—So as to make this estimate a safe one, the consumption of coke is increased from 20 per cent. to 25 per cent.

As you perceive, the labor about the works, outside of the retort and purifying houses, and *the great items of expense* that obtain in the distribution of gas, being identical, or nearly so, in both systems of gas making, are not included in this estimate.

Conclusion.

The difference in cost in favor of coal gas being 48.6—35.8=12.8 cts. per M. cubic feet. You will notice that the waste of energy in producing the water gas is somewhat compensated for by the greater economy in its labor; still, the above items of cost considered, it is $\frac{12.8}{35.8} = 35.7$ per cent. more expensive than the coal gas. Considering these facts and the present outlook as to future prices, it seems that in this vicinity the manufacture of water gas, either for lighting or heating purposes, is not advisable, if the most economical method of obtaining certain results is alone considered. It certainly is becoming in us to make coal gas (as it can be and is elsewhere made) more cheaply. This end is to be attained, to a great extent, by stopping the waste of energy now going on in our retort houses.

[From the Providence (R. I.) *Daily Journal*, Friday, Dec. 12.]

A Movement for Abolishing the Electric Districts in Providence.

IMPORTANT REPORTS OF THE SUPERINTENDENT OF LAMPS.

The quarterly report of the superintendent of lights, as follows, was read and received:

To the Honorable the Mayor and Board of Aldermen:

Gentlemen—I intended to present this day my fourth quarterly report, ending Nov. 30th, ult., which would show the following facts: Expenses for the last quarter, $27,657 11; previous quarter, $22,775 16; second quarter, $45,258 55; first quarter, $31,799 85; total for the year, $127,490 67.

The unexpended balance of appropriation which stood to the credit of this department at the end of the fiscal year ending Sept. 30, and covered in the treasury, was $5308 95. How all this had been accomplished from an appropriation of $120,000 required more municipal lore than I had in so short a time acquired, but I think I can solve the problem, besides the lapping-over-process from one quarter to another, which happily culminated at the end of the second quarter. It seems that this department, like no other, has its department year end Nov. 30, two months after the fiscal year, hence the expenses of this department, as shown by the auditor, are fully ten months in the department year, leaving two months to be paid out of the present appropriation. This is calculated to deceive the very elect; for instance, the auditor's books show that for the fiscal pear ending Sept. 30, the appropriation, $120,000, less unexpended balance, $5308 05, that the expenses of this department for the fiscal year are $114,691 05, while the department year shows the expenses have been $127,490 67. This system of bookkeeping I have never acquired, and I ask most respectfully, yet earnestly, that some relief may be granted that will put the department in its true light before the city council and the people.

This can be done, I think, by changing the department year to end either with the fiscal or municipal year.

All of which is respectfully submitted.

SAMUEL B. SWAN,
Superintendent of Lights.

Providence, Dec. 11, 1879.

The report was received and a vote was passed amending the lamp department rules so as to provide that the superintendent of the lamp department shall present his annual report in the month of January.

Alderman Smith presented the following report of the superintendent of lights with reference to the electric lamp lighting system:

To Robert E. Smith, Esq., Chairman Lamp Committee Board of Aldermen:

In answer to the three questions propounded by your committee—1st., "What is the relative expense of the hand and electric system of lighting for the three years ending October 31, 1879, and for each year separate," I have to say that herewith you will find a transcript from the books of this office, giving a minute detail and summary of the work, and to which I refer your honorable committee. I am satisfied that if this district had been placed where the moon could have been utilized, a greater saving in gas could have been shown.

The first year shows a daily saving of 31 minutes, the second year 26 minutes, third year 15 minutes, an average of 24 minutes; the elements have been against the system the past year.

The second question; "What are the relative expenses of the two departments to-day?" I long since became convinced, from observation and the conversation of the men heretofore emyloyed in cleaning lanterns, that one man could not properly clean 220 lanterns and do the other work proscribed. Accordingly, on the 27th of last month I employed a man at $1 per day to assist in cleaning. This I know adds to the expense of the department, but the lanterns, especially in the centre of the city, ought and must be kept clean.

When the wages of the man who has charge of the gas-cocks and burners were reduced from $2 50 to $2 25 per day, I allowed this man for his attendance to assist in lighting on the street, when occasion required, and to attend to any breakage that might appear, out of his regular working hours, 25 cents per day, thus keeping his pay the same as heretofore.

The man who cleaned the lanterns also attends to the pumping of the air and extinguishing in the morning, his pay was reduced from $2 to $1 50 per day when the general reduction was made. You will therefore see that the running expenses have not been increased more than I consider the interests of the department demand.

Without going into a discussion as to whether one-third of one man's time is sufficient to do the work required in the electric department (and which has always been the bone of contention in every investigation,) there appears to have been charged to this department (see report), for extra labor, stock and battery material for three years, the sum of $972 71. I shall therefore assume that the cost of these:

For one day is	$1 00
Lantern cleaner, $1 50, helper $1 00	2 50
Operator as above	25
	$3 75
Savings in gas 24 minutes average for three years	85
Net expenses of electric system one day	$2 90
Cost of lighting by hand 220 lights, 1½c.	3 30
Savings in favor of electric district	40

This does not take into account interest or depreciation.

The third question, "What would be the result if the electric system was abandoned and the hand system, with four feet burners, substituted?" These 220 light burn 5 feet per hour on an average of 12 hours per day.

The balance of the city by what are supposed to be 4-feet burners the difference in the cost of gas, less the savings by electric district, is $4.75 per day, or $1733 75 per annum.

If 4-feet burners were substituted in the electric system, the savings would be one-fifth less, or 23 per day instead of 40c. as shown above.

All of which is respectfully submitted.

SAMUEL B. SWAN,
Superintendent of Lights.

Providence, Nov. 26, 1879.

To Robl. E. Smith, Esq., Chairman Lamp Committee, Board of Aldermen, City of Providence:

Herewith please find a map of the city, upon which is located the proposed extension of the electric lighting system, together with the resolution of the Aldermen, all of which is made a part of the within report.

THE CITY OF PROVIDENCE.

Resolution of the Board of Aldermen, Nov. 26, 1879:

Ordered, That the Committee on Lamps be hereby directed to report an estimate of the cost of establishing and maintaining another district of not exceeding 250 lights operated by the electric lighting apparatus, in a section of the city where the lamps are lighted subject to the phases of the moon, both by the purchase of new apparatus therefor, or by removing the old thereto, accompanied by a map showing the lamps in such district; also to report the estimated saving over the present cost of lighting in the proposed district, and all matters in relation thereto, together with the opinion of the city solicitor upon the rights of the city in an to the said lighting apparatus under the agreement of the patentees thereof with the city of Providence.

A true copy—witness, HENRY V. A. JOSLIN, City Clerk.

Statement of the probable savings in gas to be made by the use of Bean's electric lighting apparatus upon a section of 250 gas lamps, subject to the phases of the moon:

Average number of minutes saved in lighting at dusk, as shown by three years' operations on present electric district	16
Average number minutes saved by extinguishing at daybreak	8
Average number of nights during last three years the time tables provided for the moon to light the streets before it sets	5½
Average number of nights the time table have provided for the moon to light the streets after it has risen	8
Average number of nights the time tables have provided for the lamps to be lighted	320
Average number of nights the lamps have been lighted	340
An average of 28 nights each month.	
Average number of hours the time tables provide for the lighting of the lamps before the moon sets each month	3h 14m
Two hours of which ought to be saved by the electric system.	

Therefore the savings in gas for one month and for one lamp may be estimated as follows, viz.:

Savings in lighting at dusk, 16 minutes for 23 nights	6h 08m
Savings in extinguishing at daybreak, 8 minutes for 20 nights	2h 40m
Savings in lighting before the moon sets, 2 hours for 5½ days	11h 00m
Savings in extinguishing after the moon rises, 30 min. for 8 days	4h 00m
Total	23h 48m

Multiplied by 4 cubic feet equals 95½ cubic feet, and this by $1.95 per M amounts to .18x on the savings on 250 gas lamps for 1 day is $1.65.

No estimate in the above is made of the probable savings in gas when under the hand system the lamps are lighted a number of hours before the time upon the tables, on account of the moon being obscured by clouds, but which break away a short time after the lamps are lighted. Neither has the contingency been considered when the moon, though partially obscured, can be utilized a number of hours each night, while under the hand system each policeman on his beat has to exercise his own judgment, with the result of the morning reports showing the lamps have been extinguished at all hours of the night. The savings above are also computed on the principle that the moon shall shine every night. It would take more time than I have at my command to ascertain how many times during the past three years the moon has been wholly or partially obscured when it ought to shine.

As to the cost of establishing another district, I can only give the probable cost, as no proposals have been issued. The present system cost $50 per lamp, without, it is said, much, if any, profit accruing to the contractors; but I shall estimate this district at the minimum price I have heard named, viz., $30 per lamp, which, for 250, will cost $7,500.

The compressor and fitting up for the same will cost (this also at the minimum sum) $2,500.

It should also be remembered that the expense of an air compressor and an operator ought to be borne by the whole number of lights that may be attached to this system.

As to removing the present machine to this proposed new district, I have made no estimate, as it is not practicable. If they are imperfect where they were made to go, they will be no better by removal.

The city solicitor says the interests of the city are fully protected by proper documents now on file, as he understands it.

The labor accounts may be stated as follows for the electric system (without any extra expense for taking care of the machine):

Two men to clean 250 lanterns, at $1.50 per day each	$3 00
For extra labor and repairs, as per three years' experience on the present electric district for 250 lamps for one day	1 13
Cost for labor under electric system	$4 13
The cost for cleaning and lighting 250 gas lamps under the hand system for one day, at 1½c. per lamp	3 75
Labor by electric in excess of hand system	$0 38

This taken from the savings of gas, $1.65, as shown heretofore, leaves $1.27 as the savings in one day on 250 gas lamps by the electric system.

Battery material is included in the above item for labor and repairs, though the present battery is large enough to operate the lamps throughout the city, being renewed at proper intervals.

I have endeavored to make this a full and fair report, without prejudice or partialiiy. All I wish is that the best interests of the city may be subserved in any transactions eminating from this office. Below you will find a summary:

Interest at 5 per cent. on $10,000, the estimated (minimum) cost of 250 lamps and air compressor, for one day	$1 37
Extra labor and repairs, as per experience in present electric district.	1 13
Two lantern cleaners, at $1.50 per day	3 00
One operator	3 00
Gross expenses for one day	$8 50
Deduct the savings in gas for one day	1 65
Net expenses for one day	$5 85
Cost of lighting and cleaning 250 lamps under the hand system, one day	3 75
Cost of electric over hand system, one day	$3 10

In short, the project involves an immediate outlay of $10,000 or more, to be followed by an annual loss, as shown above, of $1,041.60 if no further extension is made. All of which is respectfully submitted,

SAMUEL B. SWAN, Supt. of Lights.

Providence, Dec. 6, 1879.

Alderman Smith, with brief remarks, presented the folloping resolution:

WHEREAS, In view of the report of the Superintendent of Lights, this day received, as to the probable cost of extending the electric lighting system, and the probable savings in gas; also his report, under date of Nov. 26, as to the cost of maintaining the present electric district, so called; therefore,

Resolved, That it is inexpedient to further extend the electric lighting system at this time, or incur further expenses upon the present district, and the Superintendent of Lights, acting under the direction of the Committee on Lamps from this body, be and he is hereby directed (as soon as possible) to discontinue the present electric lighting; at the same time attach 4-foot burners on all lamps in this district, except on the principal streets; to return to the district lighted by phases of the moon all lamps not absolutely required to be lighted every night; also to discharge one man from

the force of men employed by the Providence Gas Co., who have charge of the gas-coks and burners.

ROBERT E. SMITH,
N. A. FENNER,
Committee on Lamps.

Alderman Smith moved the passage of the resolution, and asked for a call of the Board; but as several of the Aldermen stated that they did not feel prepared to act upon so important a mattter at so short a notice, the motion was withdrawn. It was then ordered that the statement of the Superintendent of Lights and the resolution be laid on the table temporarily, to be printed. Subsequently the Aldermen discovered that the reporters had copies of the documents for publication, and, as a measure of economy, rescinded the portion of the vote ordering them printed.

Fire and Explosion.

ALARMING CONFLAGRATION AT THE CONSUMERS' GAS WORKS, BALTIMORE, MD.

On Saturday, Dec. 6, at 7:35 o'clock, some oil took fire at the works of the Consumers' Mutual Gas Light Company, Lancaster street, Canton, causing two of the iron tanks which act as feeders to the generators, and which were filled with benzine, to explode. Joseph Armstrong, night foreman, and three workmen were in the building at the time, but all escaped without injury except Mr Armstrong, whose right hand and arm were burned while shutting off the oil from the supply pipe. The accident resulted from the leaking oil taking fire. There are eight generators in the building now used by the company for the manufacture of gas from oil. The generators are on the ground floor, on the east side of the building, and are fed from the second floor. To each generator there is a "feeder," consisting of an iron tank containing 90 gallons of oil. These feeders are placed along the wall, about four feet from the floor. The oil began leaking at No. 1 feeder, in the south-east corner of the generating room, by running over one of the funnels, and trickled down the wall to the first floor, where it came in contact with a gas jet and took fire. Mr. Armstrong noticed the fire while ascending from the first to the second floor, gave the alarm, and ran to cut off the supply pipe, having, in order to do so, to go near No. 1 feeder, where the oil by this time was afire, the pipes, expanding by the heat, leaking and adding fresh fuel. In doing so his right hand and arm were burned, but not seriously. The firemen had just attached their hose when No. 1 tank exploded, scattering the oil and making a loud report. The generating room was filled with gas, and the force of the explosion lifted the roof, and the walls, relieved of the support afforded by the iron girders of the roof, were sprung, the west wall outward, and the east wall inward. A large hole was made in the slate roof overhead, and pieces of slate knocked off in many places.

The firemen were making their way into the building by way of a porch leading into a second story on the east, when No. 2 tank went up, widening the breach in the roof, making a hole 30 by 15 feet. By order of Chief Hennick, however, the firemen pushed in and aided by the men of Nos. 9 and 5 engines and No. 3 truck and workmen of the company succeeded in subduing the fire before any of the other tanks had caught. The burning oil was smothered with clay and earth and the fire on the woodwork extinguished by water. The floors being of iron, the only woodwork to burn was the doors and window frames. Mr. F. H. Hambleton, engineer of the works, said that "all works generated a gas which if mixed with air will explode. This is the first accident of the kind in this city for seven or eight years. In this case the benzine overflowed from the feeders and took fire, exploding two small feeders."

There was sufficient gas in the gasometer to supply the mains and when the reporter visited the works yesterday the men were preparing to start work.—*Baltimore Gazette, Dec. 8th.*

ACCIDENT AT THE DORCHESTER GAS WORKS, ENGLAND.—The necessity for properly ventilating tar and liquor tanks has frequently presented itself to our notice, and perhaps at no time more than the present. The accident which took place at Dorchester proves how dangerous it is to keep tar or ammoniacal liquor closely covered in. We publish particulars which we have received from Mr. Osmond the manager:—On Thursday, Nov. 13, an explosion occurred at the works of the gas company, Dorchester, by which the arches covering the am. liq. tank were blown up. The cause of the accident there can be no doubt was from an escape of gas from a 10-inch main leading from the scrubber to the purifier. This main has only recently been laid, and owing to the treacherous nature of the soil, considerable sinking occurred, the lead joint in one case, it was found, being drawn nearly one inch. It is supposed the escape of gas came from this joint, and by some means entered the liquid tank. The men had just commenced the 9 o'clock charging, and two barrows of partially cooled coke had been taken over the tank, when the explosion took place. The report was tremendous, but fortunately no damage was done to any part of the machinery, and the manufacture and distribution of gas proceeded as usual. Several men received a severe shaking, but providentially no lives were lost or bones broken. The damages are estimated at £60.—*Review of Gas and Water Engineering.*

[From the St. Louis *Globe-Democrat.*]

The City of St. Louis vs. The St. Louis Gas Light Company.—Text of the Supreme Court Opinion in Full.

[On the 22d ult., the Supreme Court of Missouri overruled a motion for a rehearing of this case on behalf of the city and affirmed the former decision. The St. Louis Gas Company will probably take possession of their property at once. What will be the final arrangement as to the officers, etc., of the company is not yet fully known. The continuation of the decision in full, in this important case, is unavoidably crowded over till the next issue.—ED.]

Electric Light in Liverpool.

The Library Committee of the Liverpool Town Council seem to be very well satisfied with the result of their experiment in lighting up the Picton Reading Room by Electricity. It is admitted, however, that the effect is not all that could be desired. The lights will flicker, sputter, and hiss, and at the present moment there does not appear to be any effectual way of curbing these eccentricities. We may mention here, in connection with Liverpool, that the electric light has been introduced on board ship, for the illumination of the saloons of large sea-going steamers. The *Mendoza*, which is intended to ply on the west coast of South America, recently came round from Glasgow to Liverpool with the light in operation, and it is esteemed to be a great success. On an ocean-going steamer extra power is very cheap. A donkey-engine will drive a Gramme machine, and we can see no obstacle to the successful use of the electric light in the saloons of such vessels, if they can only find a properly-constructed lamp that will give a steady light, and make no spluttering. Although we years ago pointed out that gas might easily be made for the illumination of sea-going vessels, we recognize in the electric light a successful rival there, and have no wish to detract from its reported success.—*Journal of Gas-Lighting.*

Edison's Light in New York.

THE REPRESENTATIVES OF THE GAS COMPANIES DO NOT FEAR ELECTRIC LIGHT COMPETITION.

Chief Engineer C. V. Smith of the Manhattan Gas Light Company said yesterday:—"So far as I know, there is nothing in the recent developments regarding the electric light to cause the holders of gas stocks to lie awake nights. I am not speaking of the promises and alleged prospects of the electric light, but of what has actually been accomplished. * * * There is plenty of talk, promise, and prediction; but we have yet to see any one furnish a light as good and as cheap as gas. There has been no fright among the large holders of gas stocks—not even a flutter. There may have been some fright among a few small holders, but I am sure that if the fact of the recent sale of gas stocks had been known, there would have been a grab for all that was offered. The solid gas men are not yet alarmed at the prospect of electric light competition. The more intelligent holders of stock keep pace with all the news as to the electric light, so far as they can, and are not in the least alarmed. So far as I know, the latest improvements in the electric light have not increased the immediate probability of displacing gas with electricity. When the flurry was made last fall our directors made some investigations, and became satisfied that there will not, for some time, be any cause for us to fear. Those investigations were not trivial nor superficial, but were as thorough as they could then be made. We expect to supply a large part of the people of New York with gas for a long time to come; and if anybody has any gas stock to sell at a sacrifice, there are plenty to buy it who think it a safe investment."

Charles Place, Secretary and Treasurer of the New York Mutual Gas Light Company said: "We have no confidence in the electric light yet. There is not enough of it used to amount to any competition with gas, and no facts are furnished on which to base a comparison of the cost of the two lights. It is nothing new to hear of plans of furnishing cheap light. Every month some inventor discovers a new method of burning gas more cheaply, gets a patent, and that is the last of it. You burn our gas in the *Sun* office, although you have an electric light frequently on the outside of the building. Now, we are not going to get frightened until you have the electric light inside, and find that it is cheaper or better than gas. All the electric lights that I have seen fall far short of what is required in most places where gas light is used. At present we are not alarmed about the prospective competition of electricity."

O. F. Zollikoffer, Secretary of the Metropolitan Gas Light Company said: "So far from becoming alarmed at the recent promises of the electric light, we are confidently expecting a gradual increase in the consumption of gas. The price of gas has been reduced so low by the competition of the different gas companies with each other that we are satisfied of its ability to compete with fuel for cooking and heating purposes. All the gas companies now make a reduction in price where large quantities of gas are used. There is

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Editor—G. WARREN DRESSER.

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FRIDAY, JANUARY 2, 1880.

Official Report of Examinations of Gas for two Weeks ending Dec. 27, 1879, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

Dec. 1879.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
15	Between 9.30 A.M. and 1 P.M.	16.56	16.61	17.93	16.88	16.25	
16		16.45	16.07	18.53	16.84	16.40	
17		16.46	16.06	18.56	16.87	16.36	
18		15.57	15.81	18.28	16.70	16.23	
19		15.88	15.84	18.68	17.15	16 52	
20		16.70	16.40	19.24	17.21	16.48	
	Average	16.27	16.13	18.53	16.94	16.37	
22		16.28	16.42	18.76	16.54	16.14	
23		16 80	——	17.52	16.56	16.30	
24		16.00	17.31	19.56	16.61	16.34	
26		16.79	16.89	19.23	16.90	16.32	
27		16.18	16.69	19.03	16.94	15.79	
	Average	16.41	16.83	18.82	16.71	16.18	

Sugg-Letheby burner.

E. G. LOVE, Gas Examiner.

Improved System of Street Lighting.—

A new system of improved street lighting has been tested in Bristol, England. The present burner is retained, but the light is divided into two jets, between which is suspended a double convex lens, forming a powerful reflector, and the result is found to be an increase in lighting power of fifty per cent. Ordinary bat-wing burners are used, and the only care required to insure a perfect light is a nice adjustment of the suspended lens, so as to get the right focus and the full reflection of the light.—*N. Y. Telegram.*

a sliding scale of prices, so that when one concern uses 100,000 cubic feet a month, the price is reduced one half, or to seventy-five cents per 1,000 feet. This, of course, tends to encourage the consumption of gas. We have been at much pains to inform our customers how they can use gas economically for cooking. The electric light man does not even think of that yet. We have a room with about twenty-five different patterns of gas stoves for cooking and heating purposes, where we show them in practical operation. It will be a good many years before the electric light can do anything like that. The use of gas for cooking purposes has probably been more developed in England than here, but our American manufacturers have produced some great improvements in gas stoves. We have a big gas stove in which you can roast two turkeys, bake four loaves of bread, and boil four pots all at once for seven cents an hour I guess the electric light won't do that for some time. Our directors ordered a thorough investigation of the electric light last autumn. They employed chemists and practical men, and examined all the patents, and they could find no cause for alarm in the progress then made. There has been nothing since done that warrants a change of opinion, nor do I see anything in the course of the stock market to show any loss of confidence in gas stocks. Possibly the electric light may be practical for large spaces, for signal lights, &c., but for the purposes now requiring gas, you may say we do not think there is any immediate prospect of its being used. Our stockholders are not frightened. We expect to sell more gas instead of less."

At the Municipal Gas Light Company's office, the Secretary, P. Allen, said: "We can't tell what the electric light may come to, because the projectors of it do not make known sufficient facts on which to contrast the price of their light and ours. At present, taking all the authentic figures I can get, I do not see how they can make their light cheaper than ours. Certainly the price of gas has not been reduced on account of the electric light. We have heard many promises from Edison, but do not know what he can do yet. When we know that, we shall be able to say how it will affect the price and consumption of gas. But there are many practical details yet to be worked out. Even the electricians are divided in opinion about what he has done. When the experts disagree, how can we be expected to come to any conclusion? Possibly the electric light may succeed next year, and possibly its success may be fifty years off; at present we are not alarmed. When Edison shows us a cheaper and better light that can be used as generally as gas, it will be time enough to get frightened. The electric light is very pretty, but that is a long way from practical use in the lighting of dwelling-houses, &c."

Representatives of several companies were asked whether there was any prospect of a consolidation, but none were found who would say that they had heard of such a project.—New York *Sun*, Dec. 27.

Correspondence

[We are not responsible for the opinions expressed by Correspondents. Correspondents, in all cases, should sign their communications with their names and address in full—not for publiction, unless desired, but as a guarantee of good faith.—ED.]

Correction.

CONSUMERS' GAS COMPANY,
TORONTO, ONT., Dec. 29, 1879.

Mr. Editor: In the Report in your issue of the 2d ult., on the discussion which took place on my paper on The Lowe Gas Process, read at the last meeting of the American Gas Light Association, I find the following:

"Mr. M. S. Greenough—I would like to ask Mr. Pearson if he included in the cost of the coal gas the cost of plant, etc.?"

"Mr. Pearson—Yes."

I beg leave to state that I did not understand Mr. Greenough as having used the words "cost of plant" and if he did I misapprehended him.

I would say that the cost of plant, *i. e.*, the interest thereon, was *not* included by me in the cost of the coal gas, in calculating the difference between the cost thereof and that of the Lowe gas made at the works of the Consumers' Gas Company.

Yours, truly,
W. H. PEARSON.

The Dieterich Furnace.

NORFOLK, VA., Dec. 22, 1879.

Mr. Editor: In the JOURNAL of the 16th inst., you publish a paper prepared by Mr. Farmer, and read at the last meeting of the American Gas Light Association. This paper gives some information as to work done by the "Dieterich Furnace," and seems to be a very able effort to show up that furnace—which, by the way, seems to be very similar to the "Liegel Furnace," now used in Germany for some years,—in its best light. But some of the figures in that paper are evidently based on a misconception of facts; or, in other words, as to what can be done by the "ordinary process," which is quoted repeatedly in the paper mentioned. It is there stated that, "By the ordinary process Penn coal yields about 70 candle feet" of gas. Now, we know that Penn coal is ranked among the best caking coal mined in America, and any practical gas man, who has mined Penn coal, knows that 70 candle feet does not represent anything like the true value of that coal, even when worked by the ordinary process. The average yield per lb. of coal (Penn with a percentage of Cannelton Cannel) for the month of August, with this new process, is stated to have been 5.07 c. ft. of 17.83 candle gas. There are many of your readers who have done as well with the ordinary prrcess, which is shown to be so inferior to the new process, according to this paper. My monthly average for August was 5.14 c. ft. of 17.2 candle gas, using no cannel, and with retorts set in an old way, without plan or reason. Our coal, too, is not superior—nor equal to—Penn coal; this I know from experience. It is the duty of every gas engineer to advance the cause of true scientific gas making, if he can, be it ever so little; but to advance we must have well ascertained facts. The furnace mentioned seems to do extraordinary work in the way of burning large charges of coal, with a small percentage of coke, and in a short space of time, all of which is well worth the serious consideration and investigation of gas men; but the comparisons made should be made so as to fairly challenge criticism, and leave no weak spots, by means of which the correctness of the whole may be brought into question.

Yours Respectfully,
FREDERIC EGNER.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
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☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	*Par.*	*Bid.*	*Asked.*
Gas Co.'s of N. Y. City.				
Central	466,000	50	50	—
Harlem	1,800,000	50	35	42½
" Bonds	170,000			103
Manhattan	4,000,000	50	130	138
Metropolitan	2,500,000	100	110	115
" Scrip	$1,000,000	..	100	103
Mutual	5,000,000	100	40	45
" Bonds, gold	900,000	1000	100	105
Municipal	1,500,000	100	125	130
" Bonds	750,000		105	110
New York	4,000,000	100	65	72½
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	130
Citizens	1,200,000	20	—	70
" S. F. Bonds.	320,000	1000	100	102

Peoples	1,000,000	10	30	35
" Bonds	325,000	...	--	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	85	95
Nassau	1,000,000	25	70	75
" Ctfs.	700,000	1000	80	85
Williamsburgh	1,000,000	50	70	75
" Scrip		...	90	95
Kings Co	135,000	100	—	50
" Bonds	40,000	—	—	—
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	60	85
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md	2,000,000	100	95	98
" Ctfs., gold	1,000,000		—	103
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			132	—
Cincinnati G. & C. Co.				190
Derby of Conn	160,000	100	60	80
East Boston, Mass		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind		100	...	—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	120	125
Hempstead, L. I	25,000	100	...	—
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Jersey City	750,000	20	140	145
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	70	80
Laclede St Louis Mo.	1,200,000	100	100	165
Long Branch		20	30	40
New Haven, Conn		25	152	—

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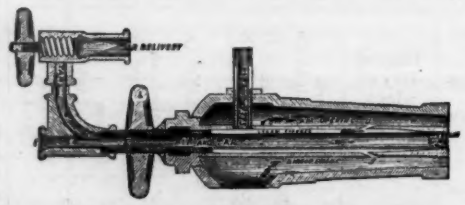

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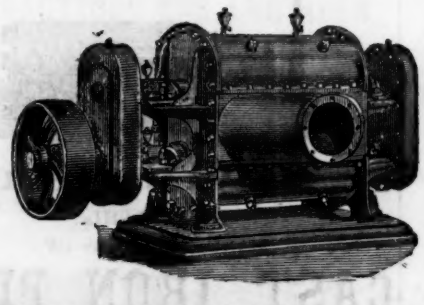

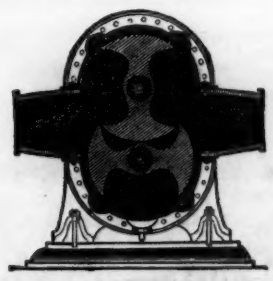

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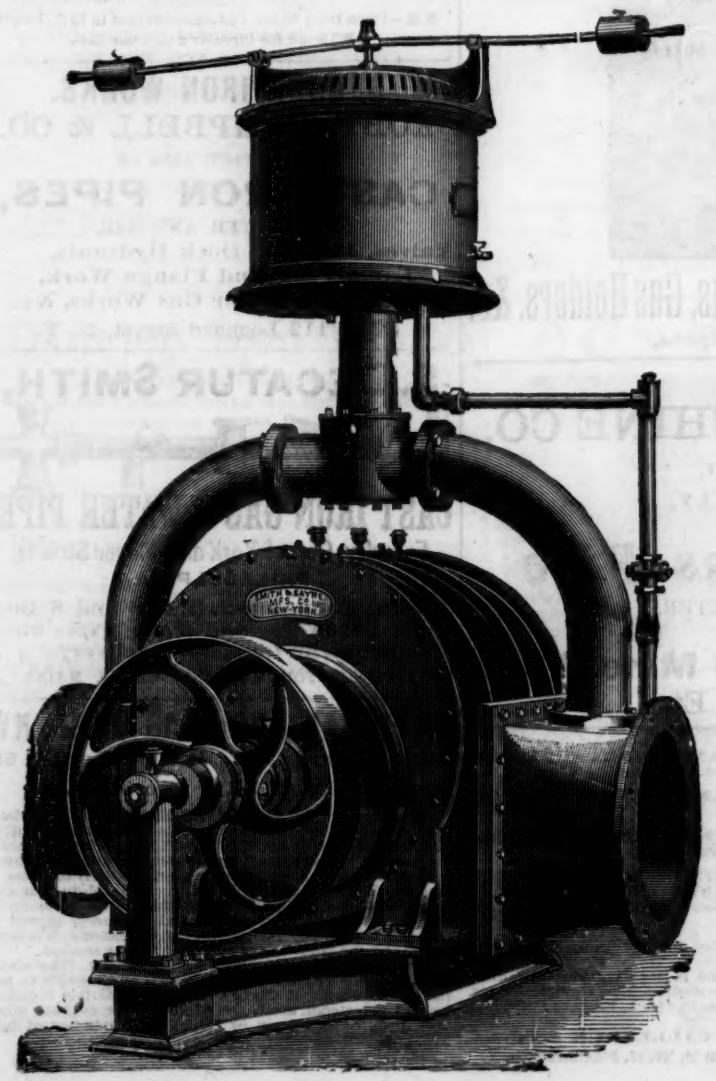

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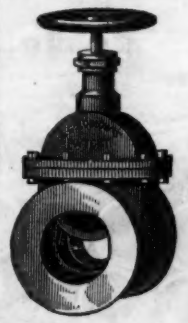

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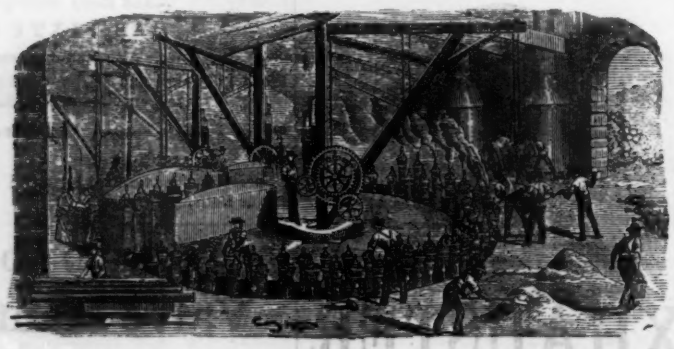

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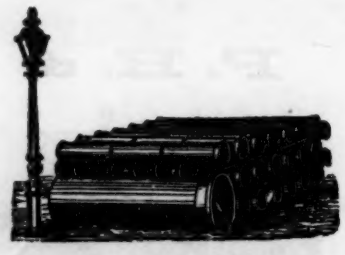

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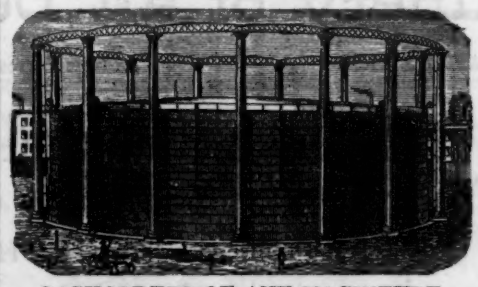

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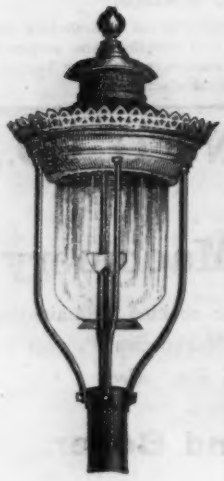

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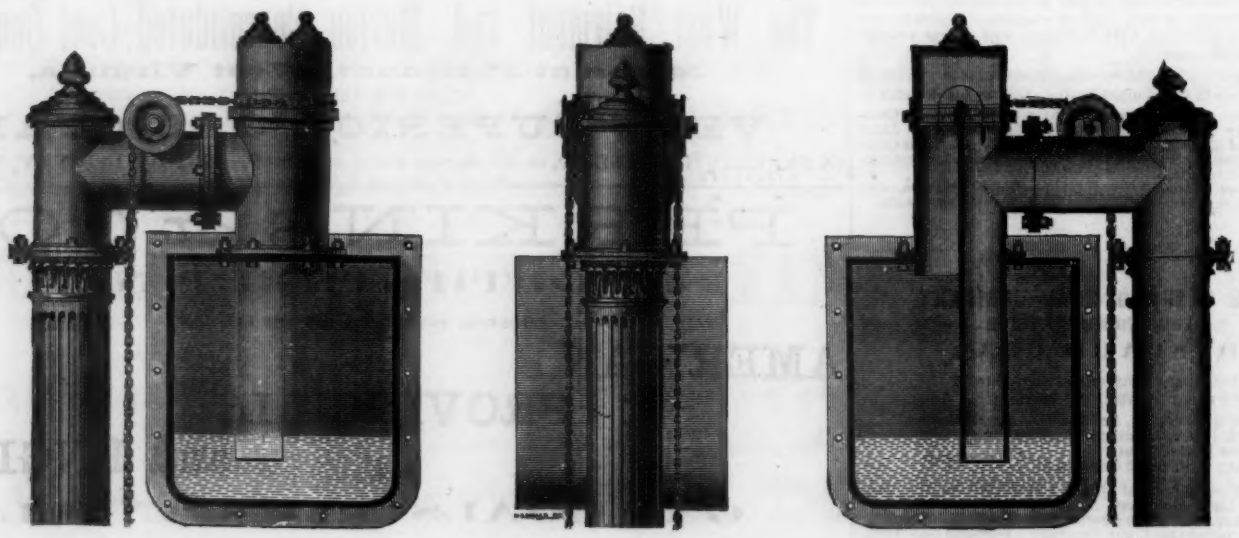

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